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Verbal Overshadowing of Visual Memories: Some Things Are Better Left Unsaid

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It is widely believed that verbal processing generally improves memory performance. However, in a series of six experiments, verbalizing the appearance of previously seen visual stimuli impaired subsequent recognition performance. In Experiment 1, subjects viewed a videotape including a salient individual. Later, some subjects described the individual's face. Subjects who verbalized the face performed less well on a subsequent recognition test than control subjects who did not engage in memory verbalization. The results of Experiment 2 replicated those of Experiment 1 and further clarified the effect of memory verbalization by demonstrating that visualization does not impair face recognition. In Experiments 3 and 4 we explored the hypothesis that memory verbalization impairs memory for stimuli that are difficult to put into words. In Experiment 3 memory impairment followed the verbalization of a different visual stimulus: color. In Experiment 4 marginal memory improvement followed the verbalization of a verbal stimulus: a brief spoken statement. In Experiments 5 and 6 the source of verbally induced memory impairment was explored. The results of Experiment 5 suggested that the impairment does not reflect a temporary verbal set, but rather indicates relatively long-lasting memory interference. Finally, Experiment 6 demonstrated that limiting subjects' time to make recognition decisions alleviates the impairment, suggesting that memory verbalization overshadows but does not eradicate the original visual memory. This collection of results is consistent with a recoding interference hypothesis: verbalizing a visual memory may produce a verbally biased memory representation that can interfere with the application of the original visual memory.

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INTRODUCTION

There are some experiences, such as the appearance of a face or color, that seem to defy words. The seeming insufficiency of words for characterizing visual memories has been supported by a large body of research suggesting that visual memories can be associated with multiple memory codes: a visual code that resembles perceptual experience, and a verbal code that includes labels of specific details (for a review see Paivio, 1986). While researchers still debate the nature of the representation of these codes, there is now substantial agreement that some components of visual memories cannot be put into words.[1] What happens then when we try to describe these nonverbal visual memories? Does verbal description supplement the original nonverbal memory or does it produce interference? The present article explores the hypothesis that describing a visual memory can result in *recoding interference:* the tendency to rely on a verbally biased recoding at the expense of the original visual memory.

The suggestion that verbal description might impair memory for visual stimuli is seemingly contrary to a substantial body of literature indicating the beneficial consequences of verbal processing. Verbal processing is central to the two most widely studied processes for improving memory performance: verbal rehearsal and verbal elaboration. Numerous researchers have observed that the verbal repetition of a stimulus improves subsequent memory performance (e.g., Darley & Glass, 1975; Glenberg & Adams, 1978; Glenberg, Smith, & Green, 1977; Maki & Schuler, 1980; Rundus, 1971; Woodward, Bjork, & Jongeward, 1973). Similarly, verbal elaboration, the formation of a semantic association between a stimulus and long-term knowledge, has been shown in numerous situations to facilitate memory performance (e.g., Craik & Tulving, 1975; Hyde & Jenkins, 1973; Tresselt & Mayzner, 1960; Shulman, 1970). Even delayed verbal recall is typically observed to improve subsequent recognition performance (e.g., Cooper & Monk, 1976; Hanawalt & Tarr, 1961; Wenger, Thompson, & Bartling, 1980). Indeed, the positive role of verbal processing, in the form of rehearsal or elaboration, has been a central component of many general theories of memory (e.g., Atkinson & Shiffrin, 1971; Craik & Lockhart, 1972; Anderson, 1983).

Although the majority of studies investigating the effects of verbal processing have used verbal materials, a number of studies have examined

[1] Even Pylyshyn (1981), one of the minority of researchers who have argued against the notion of a perceptual code admits that certain visual memories are "cognitively impenetrable" and therefore cannot be put into words. Anderson (1983), a previous opponent to the notion of dual codes, has since incorporated this distinction into his ACT* theory (Anderson, 1983). Potter and Kroll (1987) who argue for the existence of an amodal code also postulate a verbal and imaginal code.

the effects of verbalization on memory for visual stimuli. As with verbal stimuli, verbal rehearsal and verbal elaboration have been the primary paradigms for exploring the relationship between verbal processing and visual memory. In general these techniques have also revealed facilitory effects of verbal processing, although, as will be seen, an important boundary condition has emerged: the beneficial effects are typically limited to situations in which the verbally generated information is useful for subsequent memory performance.

Verbal Rehearsal

The verbal description of previously seen visual stimuli has been observed to improve recognition of both faces (Read, 1979) and pictures (Bartlett, Till, & Levy, 1980). However, Bartlett et al. (1980) observed that, at least in the case of pictures, visual recognition facilitation resulting from verbal rehearsal was limited to situations in which a verbal description could discriminate the target from the distractor.

Verbal Elaboration

It has long been known that verbal interpretation of visual stimuli can influence subsequent memory performance. For example, Carmichael, Hogan, and Walter (1932) demonstrated that associating meaningful verbal labels with abstract shapes influenced the manner in which subjects later drew the shapes. Daniel (1972) similarly observed that labeling abstract shapes biases the nature of subjects' recognition errors. With respect to overall accuracy, however, a variety of researchers have observed that labeling abstract random shapes improves subsequent recognition (e.g., Arnoult, 1956; Daniel & Ellis, 1972; Ellis & Daniel, 1971; Rafnel & Klatzky, 1978). Face recognition has also been shown to be improved by semantic interpretation. For example, making semantic judgments about a face (e.g., Does he look honest?) leads to better recognition performance than making physical judgments (e.g., Are his lips thick?) (Bower & Karlin, 1974; Patterson & Baddeley, 1977; Wells & Hryciw, 1984; Winograd, 1981). Similarly, encoding faces with verbal labels such as personality dispositions (McKelvie, 1976) or occupations (Klatzky, Martin, & Kane, 1982) has been shown to facilitate performance. As with rehearsal, however, the benefits of semantic elaboration of visual stimuli appear limited to situations in which the verbal information can distinguish the target from the distractors. For example, Klatzky et al. (1982) observed that labeling faces improved recognition when the target and the distractor resembled different occupational types (e.g., truck driver and accountant) but not when they both resembled the same occupational type (see also McKelvie, 1976).

The above review suggests that verbally processing visual stimuli adds

or emphasizes information that may be useful for subsequent memory performance. In support of this view, many discussions of the relationship of dual codes assume that the contribution of each code to memory performance is independent and additive (e.g., Bahrick & Bahrick, 1971; Nelson & Brooks, 1973; Paivio, 1986). According to this approach, information from multiple sources independently helps to increase the probability that sufficient cues will be available to make an accurate identification. While many studies have observed that verbal processing can improve memory for visual stimuli, this facilitation appears to be limited to situations in which the verbally generated information is useful for subsequent memory performance. In fact, a few studies have observed that concurrent verbal processing can interfere with subjects' ability to distinguish a target from verbally similar distractors (e.g., Bahrick & Boucher, 1969; Nelson & Brooks, 1973; Pezdek, Maki, Valencia-Laver, Whetstone, Stoeckert, & Dougherty, 1986). For example, Nelson and Brooks (1973) observed that naming pictures in a paired associate paradigm interfered with subjects' ability to learn the pairs. Pezdek et al. (1986) similarly observed that pairing pictures with corresponding schematic sentences caused subjects to falsely recognize simpler pictures that fit the earlier schematic descriptions. Bahrick and Boucher (1969) observed that requiring subjects to name a familiar object (e.g., a cup) impaired their ability to discriminate between different objects all corresponding to the same name (e.g., different cups).

Given the assumption that the verbal and visual codes are independent and additive, how can we explain the occasional observation that verbal processing interferes with visual memory? To accommodate these negative effects of verbal processing on visual memory, researchers have typically suggested that verbal processing reduces the amount of visual information that is *encoded*. Bahrick and Boucher (1969) concluded, "It would appear that the verbalizing instructions constitute, in effect, a dual task for Ss and that at higher levels of training the verbal responses occur partly at the expense of visual learning" (p. 420). Similarly, Nelson and Brooks (1973) concluded "forced involvement of the verbal system may have reduced the time available for coding the superior pictorial representation" (p. 48). Pezdek et al. (1986) suggested that the schematic sentences cause subjects to process the sentence schematically and therefore "elaborative details less essential for communicating the central scheme of a picture are less likely to be encoded" (p. 21).

Verbal interference could be an alternative to the encoding interpretation of the negative influence of verbal processing on visual memories. According to an interference interpretation, verbalization does not reduce the amount of visual information that is encoded but rather interferes with subjects' use of the visual code, thereby impairing performance when the

verbal code is not useful for making a correct identification. When verbalization occurs during encoding, the interference interpretation is entirely confounded with an encoding interpretation. Determining whether verbal processing specifically interferes with access to the visual code requires examining the effect of verbalization *subsequent* to encoding.

Using a paradigm in which subjects verbalize a previously seen stimulus not only eliminates the influence of encoding, but also provides a situation in which recoding interference may be particularly apt to occur. Visual memory interference following verbal processing may occur as a result of the interaction of two processes: (a) the influence of retrieval cues, and (b) the consequences of recollection.

The Influence of Retrieval Cues

What we remember depends on the retrieval cues present at the time of recollection. As Tulving (1984) observes: "traces have no strength independently of the condition in which they are actualized: any given trace can have many different 'strengths' depending on its retrieval conditions" (p. 233). The importance of retrieval cues is also a central assumption of dual code theory. Paivio (1986) reviews a number of studies suggesting that the relative activation of verbal and visual memory codes associated with visual memories depends on the specific retrieval cues, with verbal cues tending to activate the verbal code and visual cues tending to activate the visual code. In fact, according to dual code theory it is possible that nonverbal memories may not become associated with a verbal code until verbal processing is required (Paivio, 1986; p. 147). From this approach it follows that verbal recall of a visual memory may primarily activate (or prompt the formation of) a verbal code while failing to fully activate the visual code.

The Consequences of Recollection

Although recollection usually improves subsequent memory performance (Darley & Murdock, 1971; Hanawalt & Tarr, 1961; Hogan & Kintsch, 1971; McDaniel & Masson, 1985; Wenger et al., 1980), incomplete or inaccurate recollection can impair subsequent performance (Brown & Packham, 1967). The variable consequences of accurate and inaccurate memory recollection was recently demonstrated by Schooler, Foster, and Loftus (1988) where subjects were provided with recognition tests that either allowed for correct recollection or encouraged incorrect recollection. Subjects who received interpolated test questions that included the correct alternative performed more accurately on a recognition test than control subjects who received no interpolated test. In contrast, subjects who responded to interpolated test questions with exclusively incorrect alternatives performed less well than control subjects on a sub-

sequent test. Memory impairment resulting from responding to test questions with no correct response was observed even when the earlier incorrect distractors were omitted from the final test, suggesting that subjects were not simply biased toward their earlier responses but rather experienced memory interference resulting from their previous incorrect recollection. A reasonable interpretation of the varied effects of recollection is that additional retrievals result in the generation of multiple memory representations corresponding to the stimulus (Johnson, 1983; Mandler & Rabinowitz, 1981; McDaniel & Mason, 1985; Morton, Hammersley, & Bekerian, 1985). When recollection is accurate, the resulting veridical representation may be helpful during subsequent testing. However, when recollection is inaccurate, the resulting distorted representation may impair later memory performance.

If we combine the influence of retrieval cues with the consequences of recollection we can predict the existence of recoding interference. Specifically, if verbal recall of visual memory activates the verbal code while failing to fully activate the visual code, and if this verbally biased recollection can affect subsequent performance, then verbal recall may impair subjects' ability to use nonverbalized visual details. In short, verbal recall of visual stimuli may cause subjects to generate a recoded memory, disproportionately emphasizing the verbal code. This verbally biased recoding may then interfere with the application of the original memory.

Although rarely cited, a few early studies reported incidents of verbalization of previously seen visual stimuli impairing subsequent performance. Belbin (1950) and Kay and Skemp (1956) observed that subjects who verbally recalled a previously seen picture were subsequently less likely to correctly recognize the picture than subjects who had not recalled the picture. Admittedly, these early studies were flawed by various methodological details, e.g., distractors were not used, making it difficult to distinguish between criterion and discrimination shifts. Nevertheless, they hint at the possibility that verbalization of visual memories may generate a nonveridical recoding of the visual stimulus that can cause a decrement in later memory performance.

The present series of experiments sought to demonstrate the existence and to explore the mechanism underlying recoding interference. Experiment 1 examined the effects of verbalizing a type of visual memory that is particularly difficult to capture in words: memory for a face. Consistent with the current framework, verbal description of a previously seen face substantially impaired subjects' ability to distinguish the target face from verbally similar distractors. In Experiments 2–4 we explored the role of recoding in mediating this impairment by manipulating the match between the modality of the original stimulus and the subsequent processing. Experiment 2 compared the effects of verbalizing and visualizing a previ-

ously seen face. Experiment 3 explored the effect of verbalizing and visualizing memory for a different visual stimulus: color. Experiment 4 investigated whether verbalization within the present paradigm would have a different effect on memory for an easily described verbal stimulus: a brief spoken statement. In Experiments 5 and 6 we explored the source of recognition impairment following memory verbalization. In Experiment 5 we evaluated the hypothesis that the impairment may be due to the temporary adoption of a verbal perspective for remembering faces. Finally, in Experiment 6 we tested the hypothesis that the verbally recoded representation overshadows but does not eradicate the original visual memory.

EXPERIMENT 1

If recoding interference does occur it seems particularly likely to be observed with memory for faces. There is a substantial disparity between the quality of subjects' visual memories for faces and their ability to describe that memory (Ellis, 1984). While face recognition is typically quite good (Shapiro & Penrod, 1986), verbal descriptions of faces are often not precise enough to enable judges to distinguish a target face from similar distractors (e.g., Ellis, Shephard, & Davies, 1980). If subjects are influenced by their nonveridical verbal descriptions, then they might have considerable difficulty distinguishing the target face from distractors that also resemble the verbal description.

Relatively little research has been specifically devoted to examining the effects of verbalizing the physical appearance of a previously seen face. The few studies that have addressed this issue have not tested the hypothesis that verbalization of facial appearance may impair recognition performance when the targets and distractors are verbally similar. For example, Read (1979) examined the effects of verbally rehearsing previously presented face photos. However, Read's (1979) targets and distractors differed exclusively with respect to a quite verbalizable feature: face orientation. Furthermore, Read (1979) alerted subjects prior to verbal rehearsal that orientation was an important feature to rehearse. Since Read's paradigm encouraged subjects to verbally rehearse a feature (face orientation) that was useful for subsequent discrimination, it is not surprising the verbal rehearsal was helpful.

Mauldin and Laughery (1981) examined the effects of various face recall techniques on recognition performance. In this study, subjects viewed a photo of a face. They were then assigned to one of three basic conditions: photofit construction, in which subjects worked with an experimenter to construct a composite image of the face using an assortment of interchangeable facial features; facial feature description, in which they read adjectives describing each feature (descriptors) and then indicated

what descriptors were applicable; or control, in which they participated in an unrelated activity. Finally, subjects were given a yes/no recognition task including 130 distractors and one target. Mauldin and Laughery (1981) observed that subjects' recognition performance in both the photofit and face descriptor conditions was better than that of control subjects.

Mauldin and Laughery's (1981) experiment did not address the hypothesis that verbal rehearsal can impair the recognition of targets matched with verbally similar targets for two reasons: (1) they provided subjects with such explicit adjectives that subjects' descriptions were likely to be sufficiently precise to distinguish the targets from the distractors; and (2) the distractors used in this study were apparently quite dissimilar, as reflected by the fact that in control group the false alarm rate was only 4.3%. Thus, even if verbal description could impair subjects' ability to distinguish target faces from verbally similar distractors, such an effect might not have been observed in Mauldin and Laughery's experiment.

A few studies have hinted at the potential impairing effects of verbalization of face memory. Bartlett (1932) provided anecdotal evidence suggesting that describing a face may impair memory. Subjects who repeatedly described previously seen face drawings were reportedly surprised by the appearance of the original drawings. Bartlett suggested that this "Method of Description" might have contaminated subjects' memories. However, Bartlett was mainly interested in the nature of subjects' descriptions. Recognition accuracy was not measured, and a control group that did not describe the faces was not included.

Hall (1977) examined the effects of generating a police artist sketch on recognition accuracy. Reportedly, subjects who interacted with the police artist to produce a sketch of the target face performed less well than control subjects on the final test. This study thus provides a further hint of evidence that verbalization of faces can impair memory performance. However, the effects of verbal recall were confounded in two ways: (1) the subjects interacted with a police artist who could have used leading questions or inadvertently misled subjects in a variety of different ways (see Loftus, 1979; Schooler et al., 1988); and (2) subjects' interactions with the police artist resulted in the construction of a drawing that may have had only a minimal resemblance to the original target. Thus, the drawing, rather than the verbalization, could have been the cause of subjects' impaired recognition.

Experiment 1 examined the effects of verbalizing the appearance of a previously seen face. Subjects viewed a videotape including a salient individual. Later, subjects in the Face Verbalization condition were asked to describe the appearance of the individual's face. Control subjects participated in an unrelated task. Finally, all subjects were given a recogni-

tion test including the target face and seven similar distractors. If verbal processing simply adds to the overall strength of the memory representation, then verbalizing memory for the appearance of a face should not interfere with subjects' access to visual information and may even improve subsequent memory performance. If, however, verbal processing of visual memories causes subjects to generate a recoded version of their original memory, then verbalizing the appearance of a face may actually interfere with subsequent memory performance.

Method

Subjects. The subjects were 88 undergraduates from the University of Washington who received course credit for their participation. Experimental sessions included 6 to 10 subjects.

Procedure. Subjects in each session viewed a 30-s videotape segment depicting a bank robbery and then participated in a 20-min unrelated task that involved reading several passages and then answering some questions. Each session was then randomly assigned to one of two conditions: Face Verbalization or Control. Subjects in the Face Verbalization condition were given 5 min to write detailed descriptions of the robber's face. These subjects were encouraged to describe each facial feature in as much detail as possible for the full five minutes. Control subjects participated in an unrelated activity for an equivalent duration. All subjects were then shown a slide containing photos of eight verbally similar faces, including one photo of the robber in the earlier videotape. Subjects were instructed to indicate which face was previously seen. Subjects were also given a "not present" option to indicate that none of the photos corresponded to the robber. In addition, subjects were asked to indicate their confidence on a 9-point scale ranging from 1—guessing to 9—certain.

Results

Three aspects of performance were examined: recognition accuracy, description accuracy, and confidence.

Recognition accuracy. Verbalizing the previously seen face substantially reduced recognition performance. The target face was correctly picked by 38% of subjects in the Face Verbalization condition and 64% of Control subjects, $\chi^2(1) = 5.93, p < .05$. There were two possible types of errors: misidentifications, in which subjects selected a distractor photo; and misses, in which the subjects incorrectly indicated that the target was not present. The relative ratio of misidentifications to misses was the same for the two conditions. Approximately 59% of the errors in the Face Verbalization condition were misidentifications compared to 60% of errors in the Control condition, $\chi^2(1) = .002, p > .05$. This similar pattern of errors indicates that verbalization did not simply affect willingness to make a selection.

Description accuracy. The relationship between the accuracy of descriptions and recognition performance was also examined. Description accuracy was assessed using a method similar to that employed by Pigott and Brigham (1985) and Wells (1985). Six judges evaluated the target face

using a facial feature checklist that included various descriptors for 33 facial features. All feature descriptors for which three or more judges agreed were classified as accurate. These accurate descriptors were combined to produce a correct feature key for assessing the descriptions produced by subjects in the Face Verbalization condition. Two independent judges were trained to use the accuracy key. Training consisted of rating pilot descriptions and then comparing assessments to ensure that both judges used similar criteria. After judges reached an agreement level equal to that typically reported for face description assessment (i.e., $r >$ .80) they were given the actual descriptions to rate. Three different measures were used: (1) total features attempted—any attribute of the target face that was described regardless of whether it was included in the feature accuracy key; (2) critical features attempted—any attribute that had been included in the feature accuracy key, regardless of whether or not it was described correctly; and (3) accurate critical features—all critical features that were described using terms that approximated those previously agreed upon by at least three judges.

The judges agreed quite well. The correlation between the judges' ratings for each of the three measures were total features attempted, $r = .93$; critical features attempted, and $r = .95$; accurate critical features, $r = .85$. For each description, the mean score of the two judges' ratings was determined for each of the three measures. In addition, a fourth measure, proportion accurate, was derived for each description by dividing the mean accurate critical features by the mean critical features attempted. Comparison of the quality of the descriptions generated by subjects who were correct and incorrect on the recognition test revealed no significant differences for any of the four measures. The mean number of total features mentioned was 11.09 for subjects who made correct identifications compared to 10.26 for subjects who made incorrect identifications, $t(34) = .64, p > .05$. The mean number of critical features attempted was 8.68 for correct subjects compared to 8.02 for incorrect subjects, $t(34) = .03$, $p > .05$. The mean number of accurate critical features was 5.41 for correct subjects versus 5.43 for incorrect subjects, $t(34) = .07, p > .05$. Finally, the mean proportion of accurate features was .65 for correct subjects versus .68 for inaccurate subjects, $t(34) = .03, p > .05$.

Confidence. Subjects' mean confidence scores for accurate and inaccurate responses in the Face Verbalization and Control conditions are presented in Table 1. Subjects were significantly more confident in correct responses compared to incorrect responses $F(1,83) = 23.05, p < .01$. There was no significant difference between the mean confidence of subjects in the two conditions, $F < 1$. There was no significant interaction between accuracy and condition, $F < 1$.

TABLE 1
Mean Confidence in Responses in Experiment 1

Response	Condition		
	Verbalization	Control	Overall
Correct	7.53	8.18	7.85
Incorrect	6.30	5.93	6.17
Overall	6.77	7.39	

Note. 1 = guessing, 9 = certain.

Discussion

In Experiment 1, verbalizing the appearance of a previously seen face dramatically reduced recognition accuracy. This result represents an exception to the common observation that verbal processing improves memory performance. Since verbalization occurred well after the face was removed from view, an encoding interpretation cannot account for the present result. Rather, it appears that verbalizing the memory of a face can be a source of interference that impairs the ability to use encoded visual information.

The precise nature of the interference resulting from verbalizing a memory for a face remains unclear. One possibility is that subjects simply remember their verbatim description and the memory of this description produces interference. However, there was no relationship between the face description quality and recognition performance. (This observation is consistent with that of other researchers, e.g., Goldstein, Johnson, & Chance, 1979; Pigott & Brigham, 1985; Wells, 1985.) Since the description quality did not correspond to performance it would appear that subjects are not relying exclusively on their verbatim descriptions. Instead, the interference resulting from verbalization seems more likely to reflect a nonoptimal combination of the visual and verbal codes.

EXPERIMENT 2

In Experiment 1, subjects who verbalized the appearance of a previously seen face were less accurate than control subjects at recognizing the face. Experiment 2 sought to replicate this counterintuitive effect and to clarify the mechanism by which memory verbalization may interfere with face recognition.

In Experiment 1 there was no correspondence between the quality of subjects' descriptions and their performance. This finding raises the possibility that verbal recoding per se may not be critical to recognition impairment. If subjects generated an impoverished image of a face while

attempting to describe it, the imaging itself might have served as a source of interference. According to this interpretation, if subjects simply imagined the appearance of a face, similar impairment would be observed. Alternatively, as previously argued, decrements in recognition accuracy observed in Experiment 1 may be specifically due to recoding the original memory with a verbally biased recollection. This latter interpretation predicts that verbalization per se is a critical component of the memory impairment observed in Experiment 1. To isolate the effects of the memory impairment observed in Experiment 1, the general procedure was replicated with the addition of a third condition in which subjects visualized the face without describing it.

Method

Subjects. The subjects were 104 students at the University of Washington who participated for course credit. Experimental sessions included 6 to 10 subjects.

Procedure. Experimental sessions were randomly assigned to one of three conditions: Control, Face Verbalization, or Face Visualization. The procedure used in Experiment 1 was strictly replicated, with the sole difference being the addition of the Face Visualization condition.

Subjects in each session viewed the bank robbery videotape segment used in Experiment 1 and then participated in a 20-min unrelated filler task. Subjects in the Face Verbalization condition were given 5 min to write detailed descriptions of the robber's face. Subjects in the Face Visualization condition were given 5 min to imagine the appearance of the robber's face. The instructions for the Face Visualization condition were similar in structure to those given to the Face Verbalization subjects. Face Visualization subjects were encouraged to imagine the appearance of each facial feature in as much detail as possible. Control subjects participated in an unrelated activity for an equivalent 5-min period. Twenty-five minutes after viewing the videotape, all subjects were given the recognition task used in Experiment 1 and asked to indicate their confidence in their selection.

Results

Three aspects of performance were examined: recognition accuracy, description accuracy, and confidence.

Recognition accuracy. Describing the target face substantially impaired recognition performance compared to both subjects in the Control and Face Visualization conditions. The target face was correctly picked by 27% of subjects in the Face Verbalization condition, compared to 58% of subjects in the Face Visualization condition and 60.6% of Control subjects, $\chi^2(2) = 9.21$, $p < .05$. There was no significant difference between the relative ratio of misidentifications to misses in the three conditions, indicating that verbalization did not simply affect subjects' willingness to make a selection. Approximately 42% of the errors made by subjects in the Face Verbalization condition were misidentifications compared to 44% of errors in the Face Visualization condition and 69% of errors in the Control conditions, $\chi^2(2) = 2.82$, $p > .05$.

Description accuracy. As in Experiment 1, two judges rated each of the descriptions on three measures: total features attempted, critical features attempted, and accurate critical features. The correlations between the judges' ratings for each of the three measures were total features attempted, $r = .88$; critical features attempted, $r = .90$; and accurate critical features, $r = .92$. For each description, the mean score of the two judges' ratings was determined for each of the three measures. In addition, a fourth measure, proportion accurate, was derived for each description by dividing the mean accurate critical features by the mean critical features attempted. Comparison of the quality of the descriptions generated by subjects who were accurate and inaccurate on the recognition test revealed only one significant difference across the four measures. The mean number of total features mentioned was 9.94 for subjects who made correct identifications compared to 11.00 for subjects who made incorrect identifications, $t(39) = .88$, $p > .05$. The mean number of critical features attempted was 6.44 for correct subjects compared to 8.17 for incorrect subjects, $t(31) = 2.21$, $p < .05$. The mean number of accurate critical features was 4.78 for correct subjects versus 5.31 for incorrect subjects, $t(31) = .92$, $p > .05$. Finally, the mean proportion of accurate features was .76 for correct subjects versus .68 for inaccurate subjects, $t(31) = 1.45$, $p > .05$.

Confidence. Subjects' mean confidence scores for correct and incorrect responses in the Face Verbalization and Control conditions are presented in Table 2. Subjects were marginally more confident for correct responses compared to incorrect responses $F(2,98) = 6.78$, $p < .07$ (one-tailed test). There was no significant difference between the mean confidence of subjects in the three conditions, $F < 1$. The interaction between accuracy and condition was not statistically significant, $F(2,98) = 6.24$, $p > .05$. However, examination of Table 2 reveals that whereas subjects in the Face Visualization and Control conditions were substantially more confident when correct than when incorrect, Face Verbalization subjects were slightly less confident when correct than when incorrect.

Discussion

In Experiment 2, subjects who described the appearance of a previ-

TABLE 2
Mean Confidence in Responses in Experiment 2

	Condition			
Response	Verbalization	Visualization	Control	Overall
Correct	6.44	7.09	7.09	7.06
Incorrect	6.83	5.69	6.69	6.45
Overall	6.73	6.50	7.06	

ously seen face performed less accurately than both control subjects and subjects who visualized the face. Two conclusions can be drawn from this observation: (a) the counterintuitive memory impairment following verbalization that was observed in Experiment 1 is replicable, and (b) this impairment is not simply due to the act of visualizing the appearance of the face. This latter observation suggests that recognition interference results from the recoding process associated with verbalizing a nonverbal memory.

Since subjects are not affected by visualization one might be tempted to conclude that it is the reliance on the explicit verbalization that produces the memory impairment. However, this hypothesis was further weakened by the general lack of a relationship between description quality and recognition performance. One measure (features attempted) did suggest a possible difference in the quality of descriptions associated with correct and incorrect responses; however, since this difference was not observed in Experiment 1 (nor, as will be seen, was it replicated in Experiment 4), we suspect that this difference reflects a single Type 1 error resulting from multiple comparisons across many experiments. It seems that following memory verbalization people neither rely exclusively on their visual representation (which would lead to accurate performance) nor on their explicit verbalization (which would produce a relationship between description quality and recognition accuracy). Rather, it seems most likely that impairment results from some nonoptimal combination of these two sources.

One potential concern in interpreting the results of Experiment 2 is: Can we assume that subjects in the visualization condition actually generated an image of the target face? Unfortunately, an experimenter cannot be directly privy to the imagination processes of subjects. Nevertheless, a few observations add credibility to the assumption that subjects in the Face Visualization condition were engaging in some form of visual recall. First, a large body of research has demonstrated that college subjects readily generate mental images of complex stimuli. The behaviors that subjects exhibit while processing these imagined images (i.e., scanning rates, decision time) closely resemble those associated with actual stimuli (e.g., Finke, 1985; Kosslyn, 1980; Shepard & Metzler, 1971). If subjects in other studies readily generate images when asked to do so, it seems appropriate to infer that subjects in the present study were also generating images. In addition, even if only a subset of subjects generated an image, given the magnitude of the effect of verbalization, it would be expected that at least a trend toward reduced performance would be observed if visual rehearsal also impaired memory. The absence of such a trend further argues against the notion that the noneffect of visualization occurred because subjects failed to generate an image. Rather, the lack of an

effect of visualization seems more likely to suggest that there is some aspect of explicit verbalization that is a critical component in mediating recognition impairment.

EXPERIMENT 3

Experiments 1 and 2 explored the notion that memory impairment can result from verbally recoding a visual memory that cannot be easily put into words. Evidence for this hypothesis was gained in two respects. First, verbalization of a nonverbal visual memory (a face) was shown to impair recognition. Second, visualization did not impair face recognition. A third prediction that follows from the present framework is that similar recognition impairment should result from the verbalization of memory for other visual stimuli that are difficult to describe precisely.

In contrast to the predictions of the present framework, other lines of research suggest that the recognition impairment observed in Experiments 1 and 2 might be limited to memory for faces. There is both neurological and experimental evidence indicating that humans may have a specific memory system dedicated to human faces that may qualitatively differ from other types of memory. The occurrence of prosopagnosia, a brain-lesion-induced decrement that is primarily associated with the inability to remember familiar faces supports the notion of a dissociation between the processing of faces and other visual stimuli (Beyn & Knyazeva, 1962). Experimental research has further suggested qualitative differences in the nature of facial memory processing. For example, Yin (1969) compared the effects of inverting pictures of faces and other complex stimuli that are customarily seen only in one orientation. He found that memory for faces was disproportionately affected by inversion, suggesting some special process associated exclusively with faces. It is thus possible that verbally induced interference reflects a process that is limited to face memories. Alternatively, if the recoding interference hypothesis is accurate, impairment should generalize to other situations in which the visual memory cannot be adequately captured in words.

Color is another nonverbal memory set that might be particularly vulnerable to recoding interference. Brown (1966) demonstrated that subjects rely on their verbal descriptions in making color recognition decisions. Often subjects chose the color that best fit their description even when it was not the color that they had seen before. While considerable subsequent research has substantiated the relationship between color description and recognition performance (see Lucy & Shweder, 1979, for a review), little attention has been given to the possible influence of the description activity itself on memory. If color descriptions do not adequately characterize subjects' visual memories, then the act of describing a color might also impair recognition.

Experiment 3 explored whether the detrimental effects of memory verbalization would generalize to a different nonverbal stimulus set: color. Subjects viewed color swatches and then participated in one of three rehearsal activities: color description, color visualization, or participation in an unrelated filler activity. Subsequently, subjects were given a color recognition test.

Besides using different stimulus materials from those used in the earlier experiments, Experiment 3 included three additional modifications on the earlier memory verbalization paradigm: (a) each subject responded to three stimulus sets, thus providing a more stable measure of performance in the three conditions; (b) the "not present" option was eliminated to exclude any possible effects of changes in identification criterion; and (c) descriptions were elicited from subjects immediately after the stimulus was removed from view.

Method

Subjects. The subjects were 30 University of Washington undergraduates. Subjects were run individually.

Materials. The color stimuli were three 1 × 1-in. color chips obtained from a hardware store as samples of house paint colors. Three different color stimuli were used: red, blue, and green. Each of the three stimulus color chips were mounted individually on 3 × 5-in. blank note cards. Three recognition test strips were also constructed. The test strips included a duplicate of the target color chip and five distractor color chips selected on the basis of visual and verbal similarity to the original target. For example, the green chips could all have been described as army green. The target and distractors in each stimulus set were comparable in intensity and between shade differences, as defined by their manufacturer. The target and five distractors for each color stimulus set were mounted on 5 × 7.5-in. blank cards.

Procedure. Each subject was randomly assigned to one of three conditions: Color Verbalization, Color Visualization, or Control. The stimulus presentation was identical for all subjects. An experimenter presented a stimulus card for 5 s. Subjects then participated in one of three activities for 30 s. Subjects in the Color Verbalization condition were asked to write in as much detail as possible a description of the color. Subjects in the Color Visualization condition visualized the color. Subjects in the Control condition wrote down as many names of the United States as they could recall. Subjects were then shown a test strip and asked to indicate which of the color chips corresponded to the color they had just seen. The experimenter recorded their responses. For each subject the same process was repeated with two remaining color stimuli. The order of color presentation was randomly varied both across and within conditions.

Results

An analysis of variance was used to compare the mean number of correct color identifications per subject (maximum = 3) in the Color Verbalization, Color Visualization, and Control conditions. For the sake of clarity, each mean is presented in terms of the percentage of correct responses. Recognition of the initial color was impaired when subjects

described the color. The mean percentage of correctly identified colors was 33% in the Color Verbalization condition, 64% in the Color Visualization condition, and 73% in the Control condition, $F(2,27) = 10.01$, $p < .01$. Simple effect tests revealed no significant difference between the Color Visualization and Control conditions.

Discussion

In Experiment 3, verbal description of a previously seen color reduced memory performance. This observation suggests that the recognition impairment resulting from verbalizing memory for a face generalizes to other types of visual memory. Of course it is possible that the negative effects of memory verbalization are mediated by different processes for faces and colors. However, parsimony favors a more common explanation: memory verbalization can prompt a verbal recoding of the original memory that can interfere with subjects' ability to apply the original visual code.

Experiment 3 also replicated the observations in Experiment 2 that visualization did not significantly affect performance. This result lends further support to the notion that detrimental memory recoding results from the mismatch between the original visual stimulus and the subsequent verbalization.

A few other observations about Experiment 3 deserve brief mention. First, in previous experiments the target individual was viewed in different contexts during presentation and test. This avoided the possibility that subjects might be able to rely on easily verbalized details such as clothing and orientation. In Experiment 3 the stimulus appeared exactly the same at encoding and test, thus further generalizing the scope of situations that may be associated with verbally induced memory impairment. Second, Experiments 1 and 2 used a delayed recall paradigm in which verbalization was initiated 20 min after the stimulus was presented. In Experiment 3, the appearance of the color was verbalized immediately after the stimulus was removed from view, thus generalizing the effects to an immediate recall paradigm. Third, recognition impairment following verbalization occurred in Experiment 3 without the inclusion of a not-present option. In Experiments 1 and 2 the ratio of misses to misidentifications was similar for subjects in the various conditions, so it is not surprising that exclusion of the not-present option did not eliminate an effect of verbalization. Nevertheless, this observation formally eliminates the possibility that shifts in criterion for making an identification can account for recognition decrements following verbalization.

EXPERIMENT 4

A reasonable explanation for the unique negative effects of verbalizing

a nonverbal memory involves the relative difficulty of precisely describing such memories. While visual stimuli such as faces and colors may be visually recallable with adequate precision, verbal recall may be simply ill-suited for accurate reproduction. This analysis suggests that if identical recall instructions were used with verbal stimuli that could be reproduced accurately, a different pattern of results would be observed.

As indicated earlier, previous studies examining the effects of verbalization on verbal stimuli have typically observed memory facilitation, thus supporting the notion that the effects of verbal processing depend on the nature of the stimulus. However, it is possible that some idiosyncracy of the present paradigm other than its choice of stimulus materials was responsible for the unique effects of verbal rehearsal. To isolate the nature of the stimulus materials as a critical factor, it was important to determine whether memory verbalization can differentially affect verbal and nonverbal stimuli within the same paradigm.

Experiment 4 compared the effects of verbalizing a previously seen face and a statement. The general procedure of Experiment 1 was replicated with the addition of a third condition, Statement Verbalization, in which subjects were asked to recall in as much detail as possible the precise statement made by the robber. To test the effect of this manipulation, subjects were given a statement recognition test in addition to the face recognition test. To ensure a fair comparison between the effects of verbalization on the two measures, all efforts were made to keep the instructions, recognition test, and analysis of the statements analogous to those methods used in Experiments 1 and 2.

Method

Subjects. The subjects were 117 students from the University of Washington who participated for course credit. Experimental sessions included 4 to 11 subjects.

Procedure. Subjects viewed the videotape segment used in Experiments 1 and 2. Subjects were then assigned to the Control, Face Verbalization, and Statement Verbalization conditions. Subjects in the Face Verbalization condition were given 5 min to write a description of the appearance of the target face. Subjects in the Statement Verbalization condition were given 5 min to write the precise statement that was spoken in the video. The actual statement was "Just follow the instructions. Don't press the alarm, and you won't get hurt." Subjects in the Control condition participated in an unrelated filler activity for the 5-min period. After 5 min, all subjects participated in the unrelated filler activity for an additional 10 min and were then given the face and statement recognition tests. The order of the two tests was counterbalanced over sessions. The face recognition test was identical to that used in Experiments 1 and 2. The statement recognition test was analogous in structure to the face recognition test. Eight similar statements were provided, one of which corresponded to that spoken in the video. The statements were identical in meaning and differed only with respect to surface content (e.g., "Just do as the note says, don't touch the alarm button, and you won't get hurt"). Subjects were asked to decide which, if any, of the statements was spoken in the video.

Results

Recognition accuracy. As can be seen in Fig. 1, verbalization differentially affected memory for the target face and statement. As in Experiments 1 and 2, subjects in the Face Verbalization condition were significantly less accurate at identifying the target face than Control subjects (with respective accuracy rates of 49 and 71%), $\chi^2(1) = 3.92$, $p < .05$. Recalling the target statement, however, produced a trend toward the opposite effect; subjects in the Statement Verbalization condition were more accurate in recognizing the correct statement than were Control subjects (with respective recognition accuracy rates of 46 and 32%), although this difference did not reach significance, $\chi^2(1) = 1.88$, $p > .05$. A log linear analysis indicated that the effect of verbal recall on recognition accuracy was significantly different for statements and faces, $\chi^2(1) = 5.70$, $p < .05$.

The face recognition performance of subjects in the Statement Verbalization condition did not differ significantly from that of Control subjects $\chi^2(1) = .468$, $p > .05$. Similarly, the statement recognition performance of subjects in the Face Verbalization condition did not differ significantly from that of Control subjects $\chi^2(1) = .06$, $p > .05$.

Face verbalization accuracy. As in Experiments 1 and 2, two judges rated each of the face descriptions on three measures: total features attempted, critical features attempted, and accurate critical features. The correlation between the judges' ratings for each of the three measures were total features attempted, $r = .94$; critical features attempted, $r = .88$; and accurate critical features, $r = .93$. For each description, the mean score of the two judges' ratings was determined for each of the three

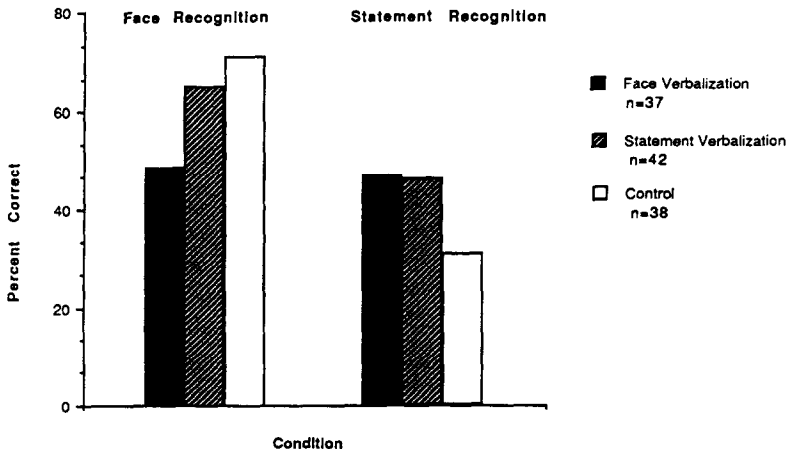

FIG. 1. Percentages of correct face and statement identifications in Experiment 4.

measures. In addition, a fourth measure, proportion accurate, was derived for each description by dividing the mean accurate critical features by the mean critical features attempted. Comparison of the quality of the descriptions generated by subjects who were accurate and inaccurate on the recognition test revealed no significant differences for any of the four measures.

The mean number of total features mentioned was 10.31 for subjects who made correct identifications, compared to 11.7 for subjects who made incorrect identifications, $t(35) = 1.59, p > .05$. The mean number of critical features attempted was 7.81 for correct subjects, compared to 8.36 for incorrect subjects, $t(35) = .76, p > .05$. The mean number of accurate critical features was 5.28 for correct subjects versus 5.11 for incorrect subjects, $t(35) = .24, p > .05$. Finally, the mean proportion of accurate features was .69 for correct subjects versus .60 for inaccurate subjects, $t(35) = 1.40, p > .05$.

Statement verbalization accuracy. Statement accuracy was assessed in a manner analogous to that used with faces. Three dependent measures were examined: words attempted, accurate words, and proportion accurate. Words attempted referred to the total number of words recalled. The accurate words measure was calculated by counting the number of words in each statement that matched those used in the original statement. The proportion accurate measure was determined for each subject by dividing the accurate words by the total words attempted. The mean scores for these measures of statement verbalization quality are presented in Table 3. There was no difference in the total words used by subjects who made correct and incorrect statement identifications, $t(40) = .73, p > .05$. However, in contrast to face descriptions, the quality of the statement verbalizations associated with correct statement recognition was substantially greater than the statement verbalizations associated with incorrect statement recognition (accurate words, $t(40) = 3.80, p < .01$; proportion accurate, $t(40) = 2.41, p < .05$.

Discussion

In Experiment 4, memory verbalization differentially affected face and

TABLE 3
Mean Statement Quality Measures Associated with Correct and Incorrect Statement Identifications in Experiment 4

	Total words	Accurate words	Proportion accurate
Correct identifications	13.5	11.7	.87
Incorrect identifications	12.9	9.1	.72

statement recognition. Whereas verbalizing memory for the appearance of a previously seen face once again impaired recognition performance, statement recognition was slightly improved following verbal recall. Thus, Experiment 4 provided further evidence that the negative effects of verbalization are particularly associated with memories that cannot be readily put into words.

Analysis of the relationship between the quality of subjects' face and statement descriptions suggests an explanation for the unique negative effects of verbalizing nonverbal memories. Specifically, it appears that the effects of memory verbalization may depend on the degree to which the verbalized information is successfully used in making a recognition decision. As before, there was little relationship between the quality of face descriptions and subsequent recognition performance, suggesting that the contents of the verbalization were not useful in making correct identifications. In contrast, there was a relatively strong relationship between the accuracy of the statements and subsequent recognition performance, suggesting that the contents of the statement verbalization were applicable. These findings are consistent with the hypothesis that reliance on verbalizations is useful when the memory for the verbalization is sufficient for making an identification. However, access to the memory for the verbally biased recoding produces interference when subjects require the original nonverbal memory.

EXPERIMENT 5

The present series of experiments suggests that describing a difficult-to-verbalize visual stimulus can cause recognition impairment. However, the nature of this impairment is still somewhat unclear. In our previous discussion of this effect we have suggested that subjects are influenced by a memory recoding associated with the generation of an impoverished verbal description. Another possibility, however, is that memory verbalization does not produce an interfering memory but rather an inappropriate processing strategy. According to this latter interpretation, verbalization causes subjects to adopt a "verbal set" in which they are temporarily prompted to think about the stimulus from a verbal perspective. If this hypothesis is correct, then with sufficient delay the verbal perspective should dissipate and the negative effect of verbalization should diminish. Alternatively, verbalization may produce an enduring memory representation that results in long-lasting impairment.

Experiment 5 examined the plausibility of the "verbal set" hypothesis by examining recognition performance for faces and statements 2 days after subjects completed their memory verbalizations. The general pro-

cedure of Experiment 4 was replicated with the one substantive change: the duration between verbalization and recognition was increased to 2 days.

Method

Subjects. The subjects were 67 University of Washington undergraduates who participated for course credit. Experimental sessions included 4 to 11 subjects.

Procedure. Subjects viewed the videotape seen in Experiments 1, 2, and 4. Immediately after viewing the videotape, subjects were assigned to either the Face Verbalization or the Statement Verbalization condition. (Notice that recognition performance in Experiment 4 indicated that verbalization only had a significant effect on the stimulus that was verbalized. Consequently, a control condition in which subjects did not verbalize either the face or the statement was deemed unnecessary. Instead, control performance was determined by comparing recognition of the verbalized measure in one condition to the nonverbalized measure in the other. For example, the control comparison for face identification in the Face Verbalization condition was face identification in the Statement Verbalization condition.)

Subjects in the Face Verbalization condition were given 5 min to write a description of the appearance of the target face. Subjects in the Statement Verbalization condition were given 5 min to write the precise statement that was spoken in the video. Subjects were then asked to return in 2 days and dismissed. When subjects returned 2 days later, they were given the face and statement recognition tests. The order of the two tests was counterbalanced over sessions.

Results

Verbalization differentially affected memory for the target face and statement in a manner similar to that observed in Experiment 4. Subjects in the Face Verbalization condition were significantly less accurate at identifying the target face than Statement Verbalization subjects (the control), with respective accuracy rates of 56 and 79%, $\chi^2(1) = 3.98, p < .05$. Verbally recalling the target statement, however, produced a trend in the opposite direction. Subjects in the Statement Verbalization condition were slightly more accurate in recognizing the correct statement than were Face Verbalization subjects (the control), with respective recognition accuracy rates of 42 and 29%, although this difference did not reach significance, $\chi^2(1) = 1.42, p > .05$.

Discussion

In Experiment 5, the effects of memory verbalization were shown to be at least relatively long-lasting. Recognition impairment for faces and a slight facilitation for statements were observed even though the recognition test occurred 2 days after verbalization. Apparently, the effects of verbalization do not simply reflect a temporary verbal "set," but rather indicate relatively long-lasting memory interference.

Although strict comparison of subjects' performance in Experiments 4 and 5 may not be appropriate, it is nevertheless of some interest to note

the similarities of the effect of verbalization in the two experiments. Since the recognition detriment did not even begin to diminish after a 2-day interval it appears that the effects of memory verbalization may be relatively resistant to the passage of time. Further, the numerical improvement following verbalization of statements was in the same direction in both Experiments 4 and 5, suggesting that it may well reflect a small positive effect of verbally rehearsing statements. Such an observation would not be surprising, given the number of studies that have shown a facilitory effect of verbalization of verbal material.

The observation that verbal recollection of a face can produce relatively long-lasting impairment also has important forensic implications. Identifying suspects is a common form of eyewitness testimony and can be the sole source of evidence in criminal trials (Grano, 1984). It is general forensic practice to ask witnesses to provide a detailed description of the appearance of a perpetrator prior to asking them to identify a suspect. In the past, describing faces has been considered harmless and has even been suspected to be helpful (Mauldin & Laughery, 1981). The current results suggest, however, that this common practice may have long-lasting detrimental effects.

EXPERIMENT 6

The results of Experiment 5 suggest that memory verbalization does not simply cause subjects to temporarily adopt an inappropriate memory strategy but rather produces some type of long-lasting memory impairment. The question remains, however, whether the memory verbalization distorts the original visual memory or whether it produces a new representation that reduces subjects' reliance on the original visual code. This distinction between memory alteration and coexistence is similar to a currently ongoing debate regarding the interpretation of the negative effects of misleading suggestions on memory. Loftus and Loftus (1980) have argued that that postevent misinformation alters the original memory. In contrast, Bekerian and Bowers (1983), Morton et al. (1985), and Christiaansen and Ochalek (1983) have suggested that both the original memory and the postevent information exist in memory.

A study by Bartlett et al. (1980) examining the beneficial effects of verbal analysis of picture memories provides some evidence supporting the coexistence of an original visual and a verbally recoded memory. Bartlett et al. observed that verbal rehearsal of previously presented pictures facilitated discriminations between verbally dissimilar photos but not between verbally similar photos. They further observed that the beneficial effects of verbalization were largely restricted to slow recognition decisions ("fast" and "slow" responses based on a median split). Bartlett et al. (1980) concluded that verbalization somehow improves the "con-

ceptual code" (a code that includes verbal information) but not the "presentational code" (an exclusively visual code). These researchers further suggested that picture recognition involves the serial access of these two codes: first the presentational code including exclusively visual information, followed by a conceptual code that also includes semantic information (see also Rabinowitz, Mandler, & Barsalou, 1977).

In Experiment 6 we sought to apply the notion of serial access of visual and verbally influenced codes to demonstrate that the negative effect of verbalization is due to interference of multiple codes. If subjects possess an original visual memory and, in addition, a new verbally biased memory, then providing retrieval conditions that favor the visual code should reduce memory impairment. To isolate the hypothesized original visual code, we limited the time subjects were given to make a recognition decision. Our reasoning was as follows: if verbalization subjects access an accurate visual code followed by a less precise verbally influenced code, then reducing subjects' time to respond should reduce their access to this latter code, and consequently performance should be improved. Experiment 6 tested the above hypothesis by replicating the basic face verbalization paradigm with a new manipulation: limiting the time subjects were given to recognize the target face.

Experiment 6 also addressed two possible limitations of the earlier face recognition studies. First, Experiments 1, 2, 4, and 5 used the same stimulus face. Although the negative effects of verbalization generalized to a completely different type of visual stimuli, color, it was still possible that the recognition impairment observed in the face studies was somehow idiosyncratic to the particular face stimulus/distractors set. Second, although the effects of verbalization were observed in Experiment 3 without a "not-present" response option, the existence of this option in the face recognition studies raises the possibility that recognition impairment for faces could be due to an identification criterion shift. Experiment 6 addressed these two additional concerns by using different faces and omitting the "not-present" option.

Method

Subjects. One hundred twelve University of Washington undergraduates participated in this experiment for class credit.

Materials. Three black and white stimulus-recognition sets were derived from a University of Washington yearbook. Each stimulus face was selected from the candid pictures that appeared in the yearbook. Each recognition set included a different photo of the stimulus individual and five distractors depicting photos of similar looking individuals. All of the photos in the recognition test were similar in format, i.e., professional posed photographs.

Procedure. Subjects were run in groups ranging from 2 to 11 subjects. Each group was randomly assigned to either the Verbalization or the Control condition, as well as to either the Limited or the Unlimited Recognition Time condition. The basic procedure was repeated

three times with the three different stimulus/recognition sets. The order in which the three sets were presented was counterbalanced.

Subjects were shown a stimulus slide for 5 s. After viewing the slide, all subjects engaged in an unrelated filler activity for 5 min. Subjects in the Verbalization condition were then asked to describe the appearance of the face in as much detail as they could. Control subjects continued to participate in the unrelated activity. After 5 min, subjects were shown the recognition test slide and asked to identify which of the six faces corresponded to the individual they had seen in the earlier slide. In the Unlimited Recognition Time condition, subjects were given as much time as they wanted to make an identification. In the Limited Recognition Time condition, prior to viewing the recognition slide, subjects were instructed that they would only have 5 s to identify the previously seen face. The recognition slide was then presented for 5 s during which time subjects made their recognition decisions. This procedure was repeated with each of the three stimulus/test sets.

Results

Each subject could correctly identify from zero to three of the faces. Overall, Verbalization subjects performed less accurately than Control subjects, and Limited Recognition Time subjects performed more accurately than Unlimited Recognition Time subjects, $F(1,108) = 15.31$, $p < .01$; $F(1,108) = 5.50$, $p < .05$, respectively. The most telling result was the significant interaction between Verbalization and Limited Recognition Time, $F(1,108) = 11.22$, $p < .01$. This interaction reflects the substantially different effect of verbalization in the Limited and Unlimited Recognition Time conditions. For subjects who were given unlimited recognition time, verbalization reduced accuracy substantially, with an accuracy rate of 50% for Verbalization subjects compared to 80% for those in the Control condition ($p < .05$, simple effects test). However, for subjects given limited recognition time, the difference between performance in the Verbalization and Control condition was negligible with an accuracy rate of 73% in the Verbalization condition compared to 76% in the Control condition, ($p > .05$, simple effects test). In fact, a simple effects test revealed that recognition performance in the Verbalization/Unlimited Recognition Time condition was significantly lower than that in the other three conditions ($p < .05$). There was no significant difference between recognition accuracy in these other conditions.

Discussion

The results of Experiment 6 clearly demonstrate that the negative effects of verbalizing nonverbal memories can be reversible. While verbally induced impairment was observed when subjects were given an unlimited amount of time to make recognition decisions, subjects who had to make very quick decisions were unaffected by their verbalizations. Indeed, the only influence of limiting recognition time was the alleviation of the negative effects of verbalization. Subjects who did not verbalize the faces were virtually unaffected by having their recognition time limited to 5 s.

There are a number of rather straightforward conclusions that can be drawn from the results of Experiment 6. First, it is clear that verbalization does not eradicate the original representation of the memory (Loftus & Loftus, 1980) but rather produces some form of interference. Second, this interference takes more than 5 s to influence performance in the present paradigm. Third, all of the information that is necessary to make an accurate identification in the present paradigm is available within 5 s. These observations are consistent with a multiple code interpretation positing that subjects who have verbalized a nonverbal stimulus first access their original visual memory followed by a verbally biased recoding. These results are also consistent with Paivio's (1985) proposition that visual information is accessed in parallel, whereas verbal information is accessed serially. The serial access of information associated with described visual memories is also suggested by Bersted's (1988) observation that memory set size is correlated with recognition time for described images but not for undescribed images.

While consistent with a substantial body of research on dual codes, Experiment 6 offers a number of unique observations. First, in the past it has been suggested that the positive effects of verbal analysis of visual stimuli may not affect the visual code (e.g., Rafnel & Klatsky, 1978). Experiment 6 suggests that the negative influences of verbalization also may leave the original visual code intact. Second, the performance improvement resulting from limiting recognition time of Verbalization subjects is rather counterintuitive. Typically, one would expect that allowing subjects more time to make a decision should improve performance rather than weaken it. It appears that not only our intuitions about verbal processing, but also our intuitions regarding the value of decision time need to be revised. Finally, the information gained by limiting subjects' recognition times in the present paradigm suggests that this technique may be a useful strategy for understanding other serial processes. Put more generally, interrupting subjects at different times during a cognitive activity may provide clues about the successive processing stages of that activity.

GENERAL DISCUSSION

While much previous research suggests that verbal processing typically improves memory performance, the present results reliably demonstrated that verbalizing memory for the appearance of a face can actually impair subsequent recognition. In addition, a systematic examination of the parameters mediating this effect has eliminated the following hypotheses:

(1) The hypothesis that negative effects of verbalization result from incomplete encoding of visual details was ruled out because verbalization occurred after the visual stimuli had already been encoded.

(2) The hypothesis that the negative effects of verbalization are a by-product of visual recall was ruled out by the observation that visualizing a face does not affect subsequent performance.

(3) The hypothesis that the negative effects of verbalization are limited to processes that are specific to faces was excluded by showing that color memory is similarly affected by verbalization.

(4) The hypothesis that the negative effects of verbalization are due to subjects' exclusive reliance on their verbatim descriptions was inconsistent with the lack of a relationship between description quality and recognition performance.

(5) The hypothesis that verbalization effects are limited to a specific face was ruled out by the observation that the effects generalize to a number of faces.

(6) The hypothesis that verbalization impairment reflects some idiosyncracy of the present paradigm was ruled out by the observation that verbalization had a very different effect on memory for statements.

(7) The hypothesis that verbalization causes subjects to temporarily adopt a general verbal strategy for remembering faces was eliminated by showing that the negative effects persist for at least 2 days.

(8) The hypothesis that verbalization distorts the original visual memory representation was eliminated by the observation that limiting recognition time alleviates the impairment.

All of the above observations are consistent, however, with the recoding interference hypothesis: the verbalization of a visual memory can foster the formation of a nonveridical verbally biased representation corresponding to the original visual stimulus. Access of this verbally biased representation can then interfere with subjects' ability to make use of their intact visual code. This interpretation explains why verbalization impairs memory for a variety of different nonverbal stimuli; in each case the nonverbal stimuli cannot be adequately recalled in words. It also explains why visualization did not impair visual memories and why verbalization did not impair verbal memories; recollection within the same modality can be veridical and consequently does not lead to an ill-matched representation. Finally, the fact that the negative effects of verbalization are alleviated when recognition time is limited suggests that subjects have an intact visual code that is later overshadowed by access to a code that has been influenced by the verbalization.

We favor the term overshadowing because it characterizes the manner in which the visual memory apparently coexists with the verbally biased recoding. Our view of recoding interference is not a traditional interference interpretation in which the interfering information impairs retrieval of the to-be-remembered information. Rather, it appears that the visual

trace is retrieved initially, but is later ignored (overshadowed) following the access of the verbally biased code. While not previously applied in the memory domain, the term "overshadowing" has been used in S–R theories to describe the relationship between a stronger and a weaker conditioned stimulus. Pavlov (1927) observed that a weak stimulus (such as a low intensity tone), capable of producing a conditioned response when presented alone, was ineffective (overshadowed) when presented simultaneously with a stronger stimulus (such as a high intensity tone). Our usage of the term overshadowing differs from Pavlov's (1927) in multiple respects: we are referring to the interaction of internal memory traces rather than external conditioned stimuli, and the overshadowing that we observed exerts its effect at the time of recollection rather than during learning. Nevertheless, both usages correspond to situations where multiple sources of information result in the apparent domination of one source over another.

The present series of experiments are generally consistent with the existence of dual codes for visual memory: one verbal, and one visual (for a review see Paivio, 1986). However, the results also suggest an important constraint on dual code theories. Most studies supporting the dual code distinction have typically suggested that information represented both verbally and visually is better recognized than information that is represented only visually, while in the present study generating a verbally biased representation impaired performance. Presumably, the critical difference is that whereas earlier studies used stimuli for which verbal information was of some value, in the present study, the verbal information was substantially less applicable than the visual code. For example, in Paivio's (1986) work, subjects are presented a visual stimulus (apple), then verbalize this stimulus ("apple"), and then are asked to recognize if they saw an apple or an orange. Since apples and oranges are verbally distinguishable, reliance on the verbal code in this case should not be harmful. By analogy, in the present study if the target differed in a readily verbalizable manner from all of the distractors (e.g., only the target had a moustache), then verbalization would not be expected to be detrimental, and might even be helpful.

Two recent studies reported since the completion of the present research provide further evidence for the hypothesis that the applicability of the verbalization may help to mediate its effects. Wogalter (1988) reports two studies examining the effects of verbal face rehearsal. In one experiment, asking subjects to verbally rehearse a face using description terms provided by the experimenter impaired performance. In a second experiment, subjects were given a different (presumably more applicable) set of descriptor terms and performance was actually better than that of

controls.[2] Read, Hammersley, Cross-Calvert, and McFadzen (1989) also provide evidence that the effects of verbalization depend on the utility of the descriptions. In this experiment, verbalization improved subjects' ability to distinguish a face that looked identical between viewing and testing, but impaired information of a face that changed somewhat in appearance. Read et al.'s (1989) results suggest that verbalization may cause subjects to rely on specific verbalizable details at the expense of a more general nonverbal code. When the face appeared the same between presentation and test, these verbalizable details were useful for discriminating the target from the distractor; however, when the face appeared slightly different, reliance on the verbally biased code was no longer functional, and the reduced consideration of the original visual code took its toll.[3]

While it seems likely that the applicability of the verbalizable information to some degree mediates the effects of verbalization, it must be noted that in the present studies there was no relationship between the quality of descriptions and face recognition accuracy. Since a relationship between verbalization quality and recognition was observed for verbalizable stimuli (Experiment 4), it is possible that this relationship depends on how likely the verbalizations are to be of use. Thus if even the relatively good face descriptions were of little value, then a relationship between face verbalization and performance should not be expected. The lack of relationship between verbalization quality and performance may also result from retrieving both verbal and visual elements combined in an idiosyncratic manner. In their discussion of the effects of verbalization on visual memory, Bartlett et al. (1980) similarly suggest that whereas the initially accessed "presentational code" is exclusively nonverbal, the subsequently accessed "conceptual code" may not be exclusively verbal. In the present paradigm, it seems almost certain that during verbalization subjects inspect their visual code to generate a verbal description. If

[2] Wogalter (1988) also included a condition in which subjects verbally rehearsed the face without using experimenter-provided descriptors. In one experiment this manipulation had no effect on recognition; in a second experiment performance was improved. The disparity between the effects of verbal rehearsal observed by Wogalter and those observed in the present series are not entirely clear. One possibility is that unlike the present study, Wogalter used the exact same face photo at presentation and test so verbalizable details of the photos may have been more applicable. Also, Wogalter did not try to select verbally similar distractors.

[3] While superficial changes in the appearance of a visual stimulus between encoding and test may influence the effects of verbalization, appearance alteration is not a necessary precondition for verbally induced memory impairment. Experiment 3 demonstrated that verbalization can be detrimental even when the stimulus was exactly the same at presentation and test.

interference results from a memory associated with generating a verbalization, and if the act of verbalization included some visualization, then it seems quite probable that the resulting verbally biased memory may have both visual and verbal features. For example, subjects may recall a few verbalized details and a visual image that highlights those details in an idiosyncratic way. Thus, the retrieved recoded memory may neither resemble the original visual memory nor the subsequent verbalization.

It is also possible that the verbally biased code may have a reduced emphasis on holistic characteristics. Encoding techniques that encourage holistic encoding of faces (i.e., assessing personality trait characteristics) produce superior recognition compared to particularistic encoding techniques such as characterizing individual facial features (e.g., Bower & Karlin, 1974; Wells & Hryciw, 1984; Winograd, 1981). In comparison to feature encoding, focusing on personality traits produces superior face recognition, but poorer verbal descriptions of faces (Wells & Hryciw, 1984). It thus appears that face recognition may primarily involve consideration of holistic qualities, while verbal description of faces may primarily involve featural qualities (Wells & Turtle, 1988). This approach suggests that verbalization may give the recoded representation a featural emphasis that makes it difficult to put the face back together again for the holistic recognition task. Such an explanation might similarly account for the color results since color has also been shown to be a holistic stimulus for which featural analysis (i.e., discriminating between hue, saturation, and brightness) is quite difficult (Garner & Felfoldy, 1970; Shepp, 1983). Thus, as in the case of faces, describing colors may cause a featural bias that is inapplicable to the final recognition test.

Another general approach that may apply to the recoded representation is Reality Monitoring theory (Johnson & Raye, 1981). According to this theory, memories for imagined and perceived events are usually associated with distinguishable memories. However, in some cases source confusions occur. Imagined events are remembered as actually having happened and vice versa. Johnson (1983) further postulates that single events may be associated with both internally and externally generated memories. In such situations, memories corresponding to internally generated ideas are postulated to have priority of access over externally experienced events (Johnson, Raye, Foley, & Foley, 1981; Raye, Johnson, & Taylor, 1980; Schooler et al., 1986; Slamecka & Graf, 1978). From this perspective the present results might be characterized as resulting from a source confusion between the initially experienced stimuli and the subsequently self-generated memories associated with the verbalization. This approach similarly assumes that subjects generate a recoded representation in the process of writing their descriptions. However, it has the additional advantage of postulating an explanation for subjects' apparent

reliance on their recoded memories: internally generated memories are assumed to have priority.

Future research will be needed to explore the above suggested mechanisms. The role of visual/verbal codes might be determined by examining the effects of concurrent visual or verbal activities. If verbal overshadowing is associated with a disproportionate emphasis on the verbal code, then concurrent verbal processing during recognition might reduce this emphasis and thereby *improve* performance. Evidence that verbalization produces a change from a holistic to a featural perspective might be gained by examining whether the effects of verbalization depend on the type of information that is most appropriate. If verbalizing a previously seen face produces a featural bias, then it may improve subjects' performance on a task requiring specifically featural knowledge, such as reconstructing a face using an identi-kit (Wells & Hryciw, 1984). Finally, the role of reality monitoring confusions may be explored by varying the source of the verbalization. If impairment is specifically due to recalling a self-generated internal memory instead of a perceptual experience, then self-generating verbalizations should produce more impairment than reading verbalizations generated by others. Ultimately, it seems likely that multiple mechanisms may play a role in the verbal overshadowing of visual memories.

It also remains to be seen what other memory stimuli are less accessible following verbalization. Memory for taste, touch, smell, sounds, affect, and frequency may also be vulnerable to verbalization. The present analysis suggests a likely criterion for whether memory for a stimulus is susceptible to verbal overshadowing: it must be associated with a memory that defies complete linguistic description. Thus, examination of the range of memory stimuli vulnerable to verbalization may not only help to explain the effect, but may also provide important clues for identifying different types of nonverbal memories.

Another interesting question is whether concurrent verbal description within the present paradigm would also produce impairment. On the one hand, verbal face descriptions generated while a face is present are likely to be more accurate then those generated after the face is no longer in view. On the other hand, attempts to train subjects to verbally characterize the features of faces to improve face memory have, in some cases, actually caused trained subjects to be worse at recognizing faces than those who had not taken the course (Malpass, 1981; Woodhead, Baddeley, & Simmonds, 1979). These negative effects of verbal training have generally been viewed as somewhat anomalous. They are, after all, contrary to our typical intuitions about verbal processing. In discussions of these face verbalization training studies, the emphasis has been on the fact that no improvement was observed, rather then that verbal analysis

actually produced deficits. Accordingly, it has been suggested that perhaps these training studies simply did not train the subjects long enough (Ellis, 1984). An alternative that has received little attention is the notion that verbally characterizing a face may reliably impair recognition performance.

In conclusion, it seems appropriate to speculate on why memory researchers so successfully documented the positive consequences of verbal processing while generally overlooking its negative consequences. While a definitive answer is impossible, one source for this oversight may lie in cognitive psychology's preoccupation with language. The bias toward verbal material and verbal processing is well-reflected in the emphasis of much memory research. Furthermore, verbal processing has been assumed to be the "deepest" and most memorable form of processing (Craik & Lockhart, 1972).

This emphasis on verbal material and the value of verbal processing may have caused theorists to overlook observations contrary to the prevailing view. As mentioned earlier, a few researchers reported negative effects of verbal recall on visual memories (Belbin, 1950; Kay and Skemp, 1956). Nevertheless, most reviews of the effects of verbal processing of visual stimuli have overlooked these studies and emphasized the positive consequences. More recent studies that have observed memory impairment following verbalization (Bahrick & Boucher, 1969; Nelson & Brooks, 1973; Pezdek et al., 1986) have avoided the suggestion of memory interference and instead concluded that this effect reflected insufficient encoding. Apparently the present Zeitgeist emphasizing the value of verbal processing has caused memory researchers to generally overlook or simply disregard its potential to produce interference.

The present results suggest that an exploration of verbal overshadowing is long overdue. The prevailing assumption that verbal processing helps memory or at worst has no effect is no longer tenable. At least with respect to visual memories for faces and colors it appears that "some things are better left unsaid."

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